APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/553,956	04/21/2000	Thomas A. Runkler	50277-452	7423

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EXAMINER
PHAM, HUNG Q

ART UNIT	PAPER NUMBER
2172	

DATE MAILED: 08/28/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)	
	09/553,956	RUNKLER ET AL.	
	Examiner	Art Unit	
	HUNG Q PHAM	2172	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☐ Responsive to communication(s) filed on _____ .

2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-34* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-34* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

    If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All b) ☐ Some * c) ☐ None of:

        1. ☐ Certified copies of the priority documents have been received.

        2. ☐ Certified copies of the priority documents have been received in Application No. _____ .

        3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

    a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>6</u>.

4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____ .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for

all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2.   **Claims 1-5, 9-13, 16-22, 26-30 and 33-34 are rejected under 35 U.S.C.**

103(a) as being unpatentable over Hall et al. [Generating Fuzzy Rules from Data].

Regarding to claims 1 and 18, Hall teaches a method of developing fuzzy rules

from continuous valued data by exploiting the properties of decision trees, a crisp

decision tree is created by creating a discrete set of fuzzy output classes and providing

a set of training example to the decision tree learning system (abstract). As shown in

table 1, a training set from the domain of tennis to determine whether to play tennis

based on the Weather: (Sunny, Cloudy), Wind (Windy, Quiet), Temperature (0, 100° F)

and there are two outcomes (Play, Don't Play) as *a plurality of data characterized by a*

plurality of features. The training set is given to C4.5 as the decision tree learning

system. The decision tree allows the classification of examples into two classes by

choosing an attribute whose values may split the examples up into more homogeneous

groups and as shown in FIG. 1, the attribute Temperature is chosen (Decision trees

from C4.5, page 1757) as the step of *selecting a feature from among the features*. Hall

further discloses that the attribute values of a continuous valued attribute are each

examined as a possible attribute to split the example set of a node in a decision tree

and a value in the data set is chosen as the "split point" (Decision trees from C4.5,

pages 1757-1758) as the step of *performing a cluster analysis along the selected feature to*

group the data into one or more clusters. As shown in FIG. 1, the decision tree is produced

as the step of *building the decision tree based on the one or more clusters*. Therefore, it

would have been obvious for one of ordinary skill in the art at the time the invention was

made to modify the Hall method of generating a decision tree by selecting a feature and

performing a cluster analysis in order to classify records of unknown class.

Regarding to claims 2 and 19, Hall teaches all the claimed subject matters as

discussed in claims 1 and 18, Hall further discloses the steps of *performing a plurality of*

cluster analyses along each of the features to calculate a maximal cluster validity measure,

said maximal cluster validity measure corresponding to one of the features; and selecting the

one of the features that corresponds to the maximal cluster validity measure (Decision trees

from C4.5, pages 1757-1758).

Regarding to claims 3 and 20, Hall teaches all the claimed subject matters as

discussed in claims 2 and 19, Hall further discloses the step: *for each of the features,*

performing a plurality of cluster analyses along said each of the features for a plurality of

cluster numbers to calculate respective partition coefficients; and determining the maximal cluster validity measure from among the partition coefficients (Decision trees from C4.5, pages 1757-1758).

Regarding to claims 4 and 21, Hall teaches all the claimed subject matters as discussed in claims 1 and 18, Hall further discloses the step of *performing the cluster analysis includes the step of performing a fuzzy cluster analysis* (Decision trees from C4.5, pages 1757-1758).

Regarding to claims 5 and 22, Hall teaches all the claimed subject matters as discussed in claims 4 and 21, Hall further discloses the step of *performing the fuzzy cluster analysis includes the step of performing a fuzzy c-means analysis* (Creating class labels and FCG, pages 1758-1760).

Regarding to claims 9 and 26, Hall teaches all the claimed subject matters as discussed in claims 1 and 18, Hall further discloses the steps of *projecting the data in each of the clusters, wherein the projected data are characterized by the plurality of the features but for the selected feature; and recursively performing the steps of selecting a feature and performing the cluster analysis on the projected data in each of the clusters* (FIG. 1, Decision trees from C4.5, pages 1757-1758).

Regarding to claims 10 and 27, Hall teaches a method of developing fuzzy rules from continuous valued data by exploiting the properties of decision trees; a crisp decision tree is created by creating a discrete set of fuzzy output classes and providing a set of training example to the decision tree learning system (abstract). As shown in table 1, a training set from the domain of tennis to determine whether to play tennis based on the Weather: (Sunny, Cloudy), Wind (Windy, Quiet), Temperature (0, 100° F) and there are two outcomes (Play, Don't Play). The training set is given to C4.5 as the decision tree learning system. The decision tree allows the classification of examples into two classes by choosing an attribute whose values may split the examples up into more homogeneous groups. The attribute values of a continuous valued attribute are each examined as a possible attribute to split the example set of a node in a decision tree. The selection of a specific value is based upon the maximum information gain or *maximal cluster validity measure* (Decision trees from C4.5, pages 1757-1758) as the step of *performing a plurality of cluster analysis along the selected feature to calculate a maximal cluster validity measure, said maximal cluster validity measure corresponding to one of the features*. As illustrated in FIG. 1, the attribute Temperature is chosen with the maximum information gain of 0.459 as the step of *selecting the one of the features corresponding to the maximal cluster validity measure*. As shown in FIG. 1, based on the maximum information gain of 0.459 using 80 as the split point, the decision tree is produced as the step of *subdividing the data into one or more groups based on the selected feature; and building the decision tree based on the one or more groups*. Therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made

to modify the Hall method of generating a decision tree by performing a cluster analysis,

selecting the feature based on maximal cluster validity measure and subdividing the

data in order to classify records of unknown class.

Regarding to claims 11 and 28, Hall teaches all the claimed subject matters as

discussed in claims 10 and 27, Hall further discloses the step: *for each of the features,*

performing a plurality of cluster analyses along said each of the features for a plurality of

cluster numbers to calculate respective partition coefficients; and determining the maximal

cluster validity measure from among the partition coefficients (Decision trees from C4.5,

pages 1757-1758).

Regarding to claims 12 and 29, Hall teaches all the claimed subject matters as

discussed in claims 10 and 27, Hall further discloses the step of *performing the cluster*

analysis includes the step of performing a fuzzy cluster analysis (Decision trees from C4.5,

pages 1757-1758).

Regarding to claims 13 and 30, Hall teaches all the claimed subject matters as

discussed in claims 10 and 27, Hall further discloses the step of *performing the fuzzy*

cluster analysis includes the step of performing a fuzzy c-means analysis (Creating class

labels and FCG, pages 1758-1760).

Regarding to claims 16 and 33, Hall teaches all the claimed subject matters as discussed in claims 10 and 27, Hall further discloses the steps of *projecting the data in each of the group, wherein the projected data are characterized by the plurality of the features but for the selected feature; and recursively performing the steps of selecting a feature, comprising selecting a new one of the features corresponding to a new maximal partition coefficient and subdividing the data into one or more new groups based on the selected new feature* (FIG. 1, Decision trees from C4.5, pages 1757-1758).

Regarding to claims 17 and 34, Hall teaches a method of developing fuzzy rules from continuous valued data by exploiting the properties of decision trees; a crisp decision tree is created by creating a discrete set of fuzzy output classes and providing a set of training example to the decision tree learning system (abstract). As shown in table 1, a training set from the domain of tennis to determine whether to play tennis based on the Weather: (Sunny, Cloudy), Wind (Windy, Quiet), Temperature (0°, 100°F) and there are two outcomes (Play, Don't Play). The training set is given to C4.5 as the decision tree learning system. The decision tree allows the classification of examples into two classes by choosing an attribute whose values may split the examples up into more homogeneous groups. The attribute values of a continuous valued attribute are each examined as a possible attribute to split the example set of a node in a decision tree. The selection of a specific value is based upon the maximum information gain or *maximal partition coefficient* (Decision trees from C4.5, pages 1757-1758) as the step of *performing a plurality of fuzzy cluster analysis along each of the features to calculate a*

maximal partition coefficient and a corresponding set of one or more fuzzy clusters, said

maximal partition coefficient corresponding to one of the features. As illustrated in FIG. 1,

the attribute Temperature is chosen with the maximum information gain of 0.459 as the

step of *selecting the one of the features corresponding to the maximal partition coefficient.*

As shown in FIG. 1, based on the maximum information gain of 0.459 using 80 as the

split point, the decision tree is produced as the step of *building the decision tree based on*

the corresponding set of one or more fuzzy clusters. Therefore, it would have been obvious

for one of ordinary skill in the art at the time the invention was made to modify the Hall

method of generating a decision tree by performing a fuzzy cluster analysis and

selecting the feature based on maximal partition coefficient and in order to classify

records of unknown class.

3.   **Claims 6, 14, 23 and 31 are rejected under 35 U.S.C. 103(a) as being**

unpatentable over Hall et al. [Generating Fuzzy Rules from Data] in view of Shafer

et al. [SPRINT: A Scalable Parallel Classifier for Data Mining].

Regarding to claims 6, 14, 23 and 31, Hall teaches all the claimed subject

matters as discussed in claims 1, 10, 18 and 27, but fails to disclose the step of

performing the cluster analysis includes the step of performing a hard cluster analysis. Shafer

teaches a method of forming a decision tree by performing a hard cluster analysis

(Shafer, SPRINT: A scalable Parallel Classifier for Data Mining, pages 544-550,

especially Abstract and Introduction pages 544-545). Therefore, it would have been

obvious for one of ordinary skill in the art at the time the invention was made to modify

the Hall method by including the technique of hard cluster analysis in order to optimize

the system by using a regular cluster for classifying records of unknown class.

     4.   Claims 7-8, 15, 24-25 and 32 are rejected under 35 U.S.C. 103(a) as

being unpatentable over Hall et al. [Generating Fuzzy Rules from Data] in view of

Choe et al. [On the Optimal Choice of Parameters in a Fuzzy C-Means Algorithm].

     Regarding to claims 7, 15, 24 and 32, Hall teaches all the claimed subject

matters as discussed in claims 1, 10, 18 and 27, but fails to disclose the steps of

calculating a domain ratio of a difference in domains limits of the data over a difference in

domain limits of a superset of the data; determining whether the domain ratio has a

predetermined relationship with a predetermined threshold; and if the domain ratio has the

predetermined relationship with the predetermined threshold, then grouping the data into a

single cluster. Choe teaches a clustering criterion based on an error tolerance ϵ as *a*

predetermined threshold by calculating a cluster center to update a fuzzy c-partition U, if

the different between two consecutive U is less than or equal the error tolerance as *a*

predetermined relationship, the data is grouped into the cluster (Choe, Fuzzy C-Means

Algorithm, ALGORITHM 1, Step 6). Thus, instead of the different between two

consecutive U, a domain ratio could be used and still give the same result. Therefore, it

would have been obvious for one of ordinary skill in the art at the time the invention was

made to modify the Hall method by using a domain ration in order to cluster data in a

finite set.

Regarding to claims 8 and 25, Hall and Choe teaches all the claimed subject

matters as discussed in claims 7 and 24, Choe further discloses the step of *determining*

whether the domain ratio is less than the predetermined threshold (Choe, Fuzzy C-Means
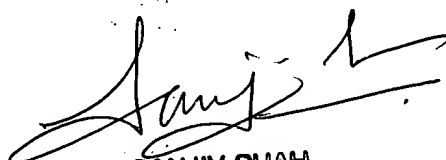
Algorithm, ALGORITHM 1, Step 6).

Conclusion

5.   Any inquiry concerning this communication or earlier communications from

the examiner should be directed to Hung Pham whose telephone number is 703-605

4242. The examiner can normally be reached on Monday-Friday, 7:00 Am - 3:30 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, VU, KIM YEN can be reached on 703-305 4393. The fax phone numbers

for the organization where this application or proceeding is assigned are 703-746 7239

for regular communications and 703-746 7238 for After Final communications. Any

inquiry of a general nature or relating to the status of this application or proceeding

should be directed to the receptionist whose telephone number is 703-305 3900.

Examiner: Hung Pham
August 15, 2002

SANJIV SHAH
PRIMARY EXAMINER